

Low-Emission, Low-Cost Hydrogen & Graphite from Methane Pyrolysis.

Snapshot & Value Proposition.

Innovative low emission, low-cost methane pyrolysis technology producing clean hydrogen and graphite

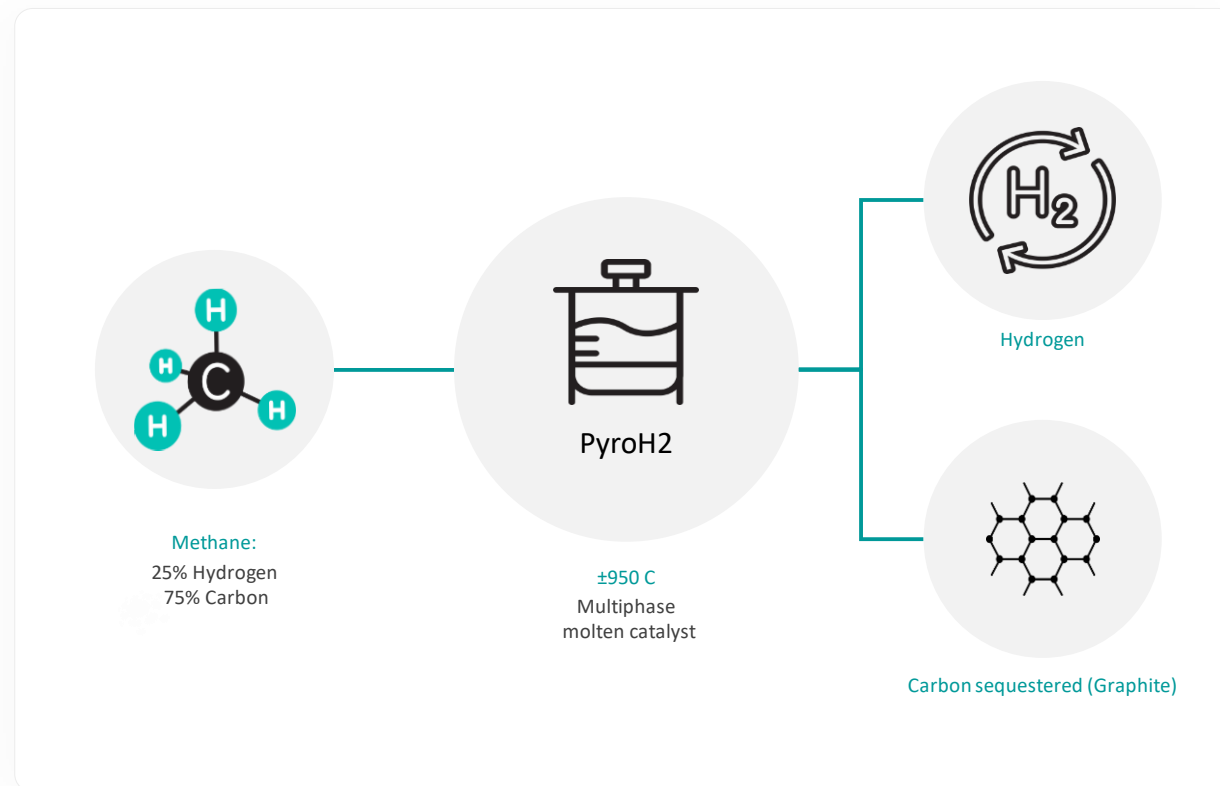


Methane Pyrolysis is a new frontier in H₂ generation, involving heating natural gas without oxygen, which produces turquoise hydrogen and solid carbon for utilization or sequestration.



PyroH2's innovation consists of a multiphase molten metal reactor that enables the conversion of natural gas and similar bio methane feedstocks, into hydrogen and graphite, **combining the advantages of both solid and liquid phase catalysts. (low activation energy, and separatable carbon, respectively).**

The company's innovation is based on a technology developed at Prof. Brian Rosen's lab at Tel Aviv University which published and patented the breakthrough technology in 2023



Team



Yossi Ron

Co-Founder & CEO

Experienced senior executive in the chemical and energy sectors; recently stepped down as ICL VP of Energy & Strategic Projects where he was one of the founders of the Dead Sea Magnesium Metal Division; former CEO of Baran Advanced Technologies and CEO of Baran Engineering & Project that rejoined ICL to take on the development and construction of the large Power Plant in Sdom.



Prof. Brian Rosen

Co-Founder & CSO

Vice Dean, Prof. Dept. of Materials Science and Engineering, Tel Aviv University. U.S. DOE Office of Science Graduate Fellow (DOE-SCGF) in 2010

Author of over 20 patents

Co-founder of Finto Power
(acquired by SolarEdge)

Elected to U.S. National Academy of Inventors
(NAI) in 2025



Dr. Oded Harel

CTO

An experienced Process engineer, led the ICL Dead Sea site R&D as R&D Director. Years of practical experience in adapting and assimilating technologies into the chemical industry, improving processes and working at high temperatures environments.

Market Deep Dive

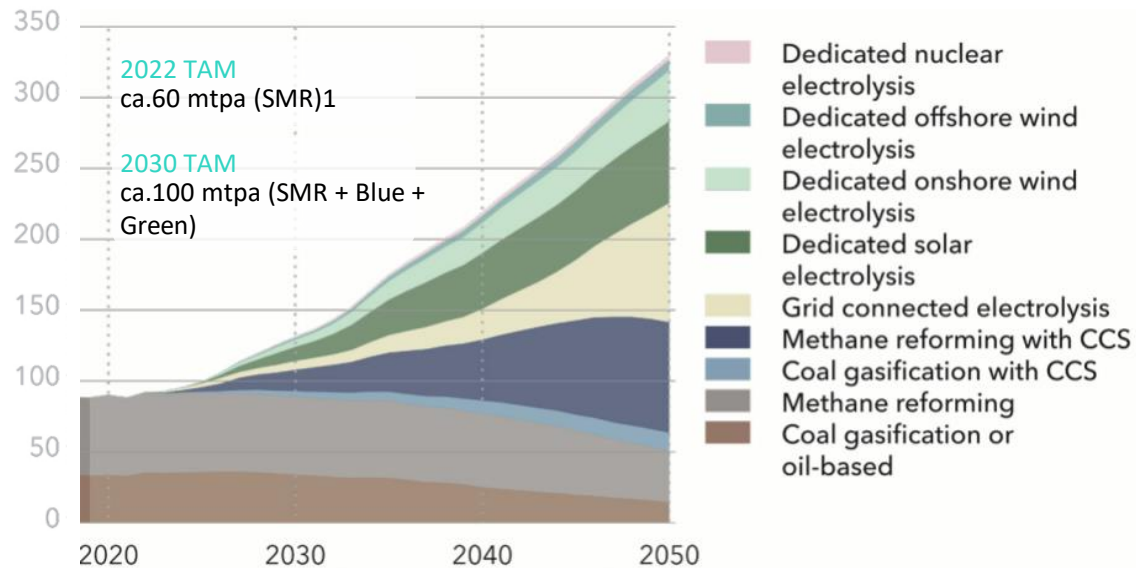
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The Market for Turquoise H₂

World hydrogen production by production route

Units: MtH₂/yr



Source: Hydrogen Forecast to 2050, DNV, 2022

01.

The overall H₂ market could grow¹ from 95m/t in 2022 — entirely carbon intensive hydrogen — to more than 140m/t in 2030 and over 300m/t in 2050.

02.

The Pyrolysis TAM by 2030 could take on the segment of projected SMR capacity, plus parts of Blue & Green H₂ (where gas is available).

03.

The demand for low emissions hydrogen could evolve from ammonia for fertilizers mostly, to transport (shipping fuel), methanol, iron & steel, power and beyond.

04.

PyroH₂ will address firstly the heavy industry & steel applications, with potential pilots with the power industry.

The Need

Low Emission, Low Cost H₂.



Hydrogen could reach 10%-14% of the final energy demand in 2050 to mitigate emissions in hard-to-abate sectors.



Most hydrogen produced today (96%) is Grey with high CO₂ footprint (2% of global emissions).[1]



Pyrolysis is a good pathway for owners of natural gas reservoirs with strong incentive to maintain their resource value.



Green H₂ expensive, based on expensive catalysts and has a carbon footprint if not driven by renewable energy.



Blue H₂ captures <43% CO₂ emissions, storage reservoirs constraints are an issue [2]



Turquoise H₂ could be cheaper than Green H₂ & could make Blue H₂ obsolete.

[1] <https://www.energy.gov/eere/fuelcells/hydrogen-fuel-basics>

[2] [Blue hydrogen: Not clean, Not low Carbon, Not a Solution](#)

	Grey H ₂	Blue H ₂	Turquoise H ₂	Green H ₂
Feedstock	Methane	Methane	Methane	Water
Tech	SMR	SMR + CCS	Pyrolysis	Electrolysis
Emissions	High-CO ₂	Medium upstream + capture leakages	Low upstream only	CO ₂ free (w/renewables – except alternative*)
Price	\$1-1.5/kg	\$2-3/kg** (disposal of carbon)	\$1.5-3/kg* (carbon has commercial value)	>\$5-6/Kg**
Can use existing infrastructure?	Established	Low capture effectiveness & carbon storage reservoirs constraints	Using existing NG infrastructure & produced at consumption point	Lack of renewables; high costs of electrolyzes
		**BNEF 2023		*Estimated as per TEA draft

Technology Deep Dive

Low-Emission & Low-Cost Hydrogen & Graphite from
Methane Pyrolysis



The Challenge Turquoise H₂

B

Non-Separable
Carbon
Separable
Carbon

Catalyst	Activation Energy (kJ)
Ni-Bi liquid	208
Bi liquid	310
Gas-phase (25)	422
Ni (26)	65
Activated C (26)	194
C black (27)	205-236
Graphite, CNTs, nanotubes (28)	>carbon black

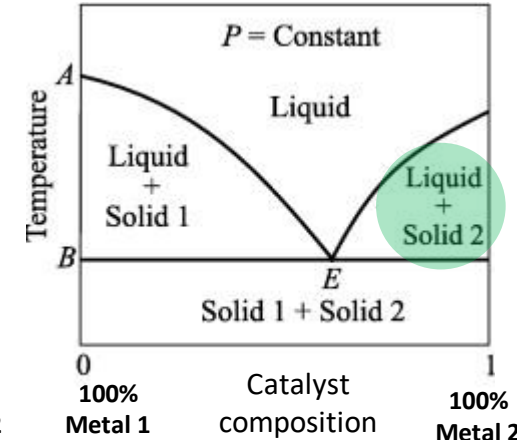
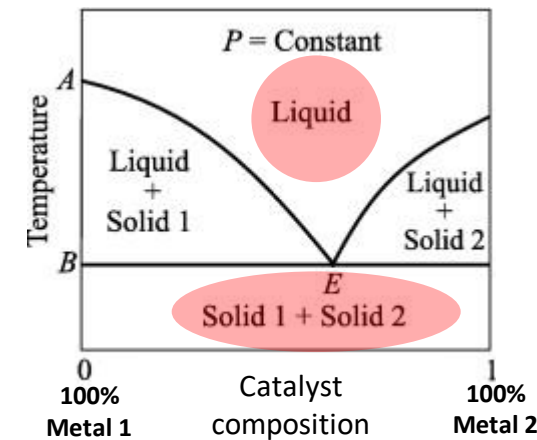
Liquid

Molten **liquid** catalysts have high activation energies (**very slow reaction rate**), but allow for carbon to be easily separated from the catalyst, avoiding deactivation

Solid

Solid catalysts have low activation energies (fast reaction rate) but **suffer from deactivation due to carbon accumulation which cannot be easily separated** (coking)

The PyroH₂ Solution



Our patented catalyst is designed to exist in both the liquid and solid state simultaneously, whereby providing for **continuous carbon separation, and high reaction rates**

The Technological Innovation:

PyroH2 Multiphase Molten Catalyst

Advantages of solid and liquid phase catalysts combined
Traditional generic problems eliminated



Solved the **coking** problem of solid catalysts, and **activation energy** problem of liquid.



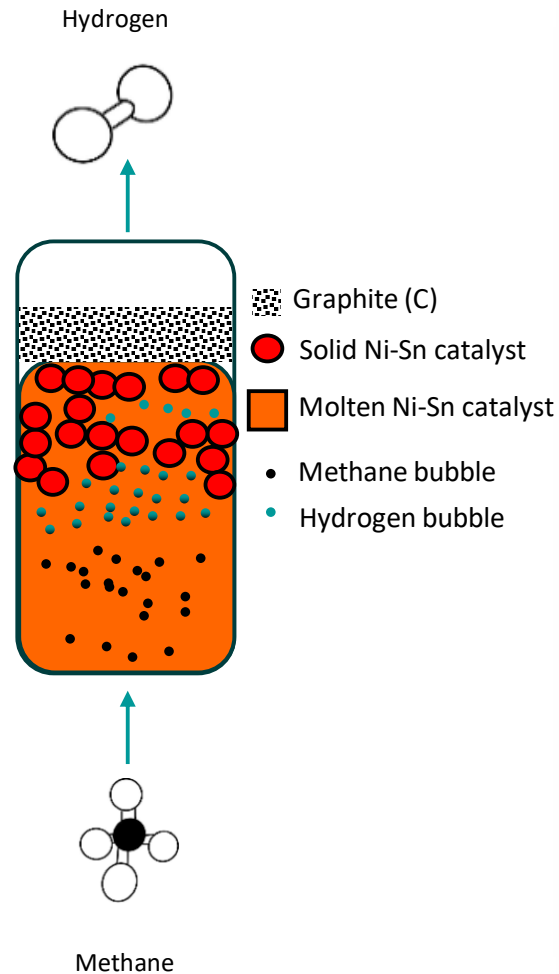
Allowing for **catalyst regeneration** without stopping the pyrolysis reaction allowing for continuous operation, unlike traditional Pyrolysis methodologies.



Lower Temperature requirements compared with “carbon bed” reactors. Hence less energy consumed and **cheaper construction materials**



Higher certainty of scale and longevity compared to microwave and Plasma pyrolysis,



- ✓ Solid alloy
- ✓ Liquid alloy

Concept driven opportunities:

PyroH2 Vertical Column Modular Approach

Highly adaptable to existing infrastructure and site constraints. Significantly reduced O&M Costs.



The vertical build, **smaller footprint**, allows for easier installation as add-on to existing installation.



Modularity of the units allow for adaptation to specific requirements of installed units and gradual decarbonization investments over time



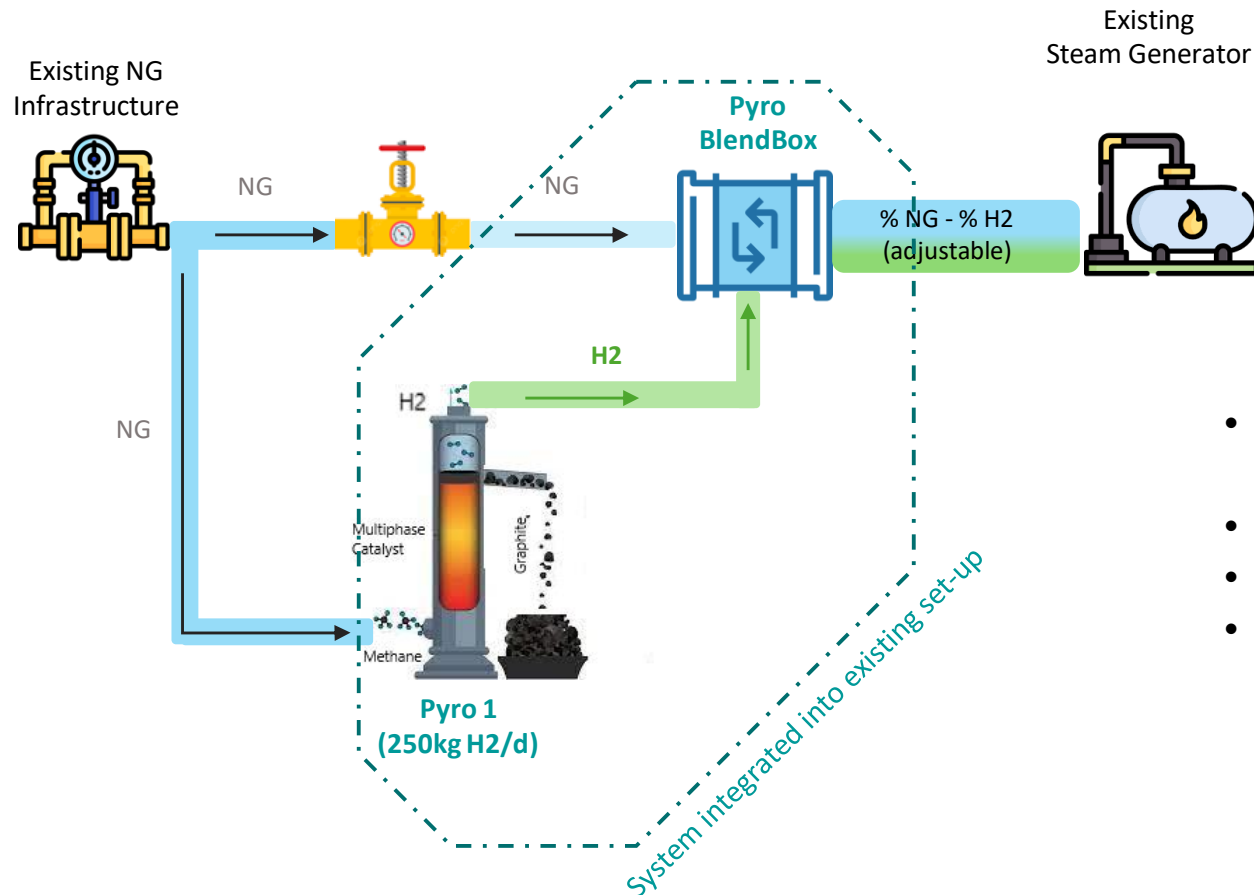
The modular unit is designed to allow installation parallel to existing NG systems allowing for **variable mixes of H2/NG**



Easily **expandable operation** as modules can be added to satisfy growing demand for H2.



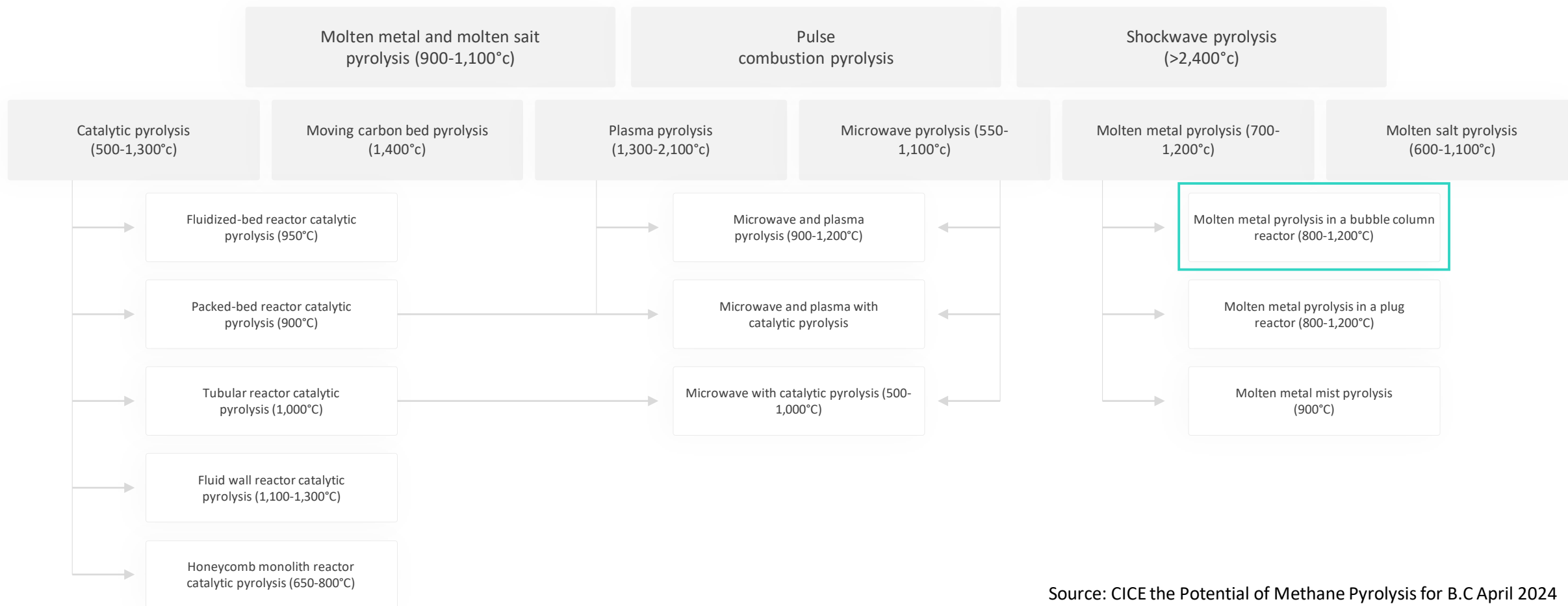
Low Capex & Economically Feasible Phased Decarbonization



- On-line conversion of Methane to H₂ seamlessly **integrated into existing infrastructure**
- Mix proportions controlled and adjustable
- 1- 4 **Pyro 1** units (250kg H₂ / d) in a system/cluster
- A unit can be stopped for O&M without stopping the entire system/cluster

Competition By Tech Landscape

Methane pyrolysis technologies and their reaction temperatures



Source: CICE the Potential of Methane Pyrolysis for B.C April 2024

Competitive Landscape

	Founded	Raised (\$m)	Technology	Status	Limitations
Monolith	2012	420	High temperature electric heating - plasma	Commercial plant (13 t/d) in Nebraska 2020, expansion to 165 t/d in 2026.	Plasma based, likely high Capex and energy costs complicated processing and O&M
Modern Hydrogen	2015	58	High temp pyrolysis	2 micro demo plants (5 kg/d) 2023, pilot plant (500 kg/d) 2024	Non-catalytic thermal pyrolysis. Low reaction rates or very high temperatures
C-Zero (US) / Graphitic Energy	2020	49	Bubble column molten metal / salt pyrolysis	Pilot plant (400 kg/d) soon to be commissioned (?), commercial plant (6 t/d) 2025. Raised \$34M in 2022 led by SK Gas.	Molten salt pyrolysis – lower reaction rates
Levidian	2012	14	Microwave Plasma + thermal reactor (LOOP)	Demo – produces 15t of graphene per year	Plasma based, likely high Capex and energy costs complicated processing and O&M
Hiiroc (UK)	2019	47	Vortex plasma torch and molten metal pyrolysis	2 demo plants in operation (UK), pilot plant (400 kg/d) in Germany 2023	Hot plasma, likely high Capex and complication
Molten	2021	25			
Hazer Group (AU)	2010		Low temp fluid bed iron ore catalytic pyrolysis	Demo plant (275 kg/d) in Perth 2023, commercial plant (7 t/d) in BC 2025.	Fluidized bed reactor of iron. Carbon accumulates on the iron catalyst. Some iron is still in graphite even after post-processing (80-95% purity graphite)

2025 - 2026

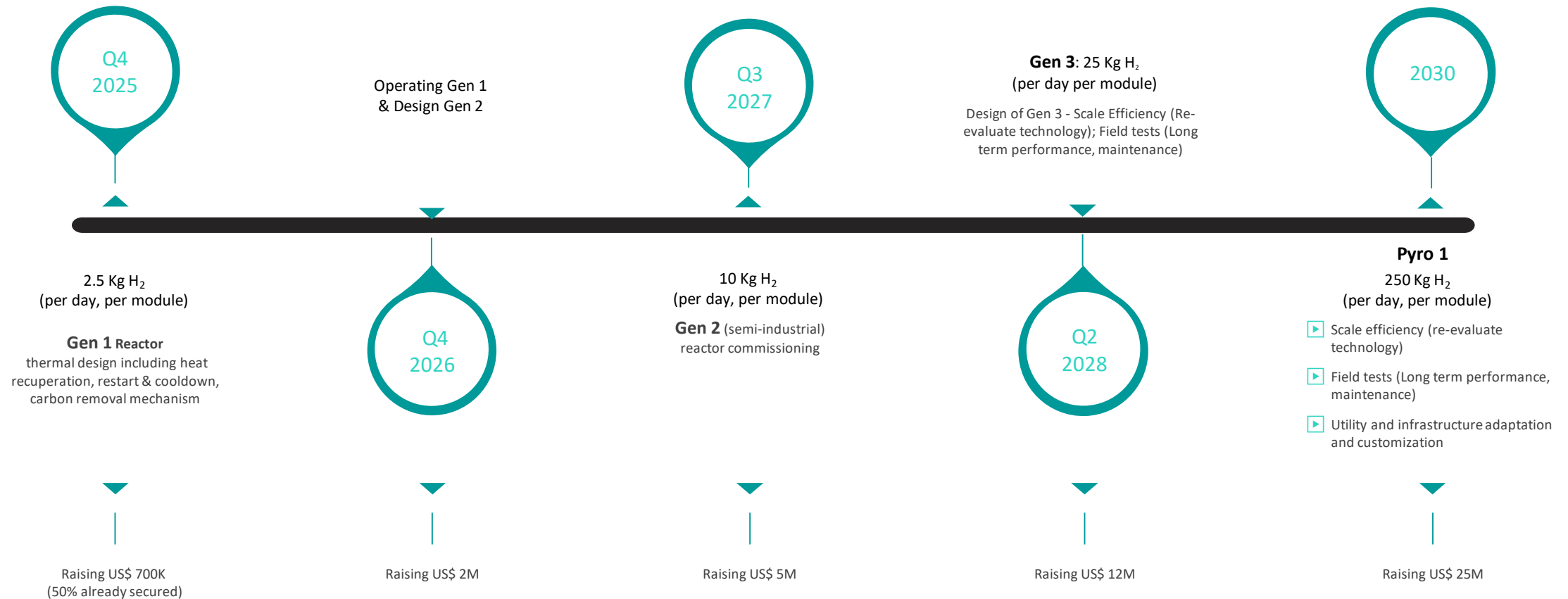
Technology High Level Workplan

Reactor Development:

- **Gen 0** – Expanded lab proof of concept
- **Gen 1** – 2.5 kg/d
- **Gen 2** – 10 kg/d - continuous operation
- **Gen 3** - 25 kg/d - continuous operation – balance of plant – semi commercial
- **Pyro 1** – 250 kg/d - commercial, customizable basic module

	Tech	Status	Notes
2025			
Q1	Gen 1	Design SOW sent to engineering firms	Done
Q1	Gen 1	Engineering firm selected	Done
Q1	Gen 0	Specified, procurement defined	Done
Q2	Gen 0	Assembly & commissioning, test runs	
Q3	Gen 1	Conceptual design approved	(Innovation Authority milestone)
Q3	Gen 1	EPCM project tendered, Basic design start	
Q4	Gen 1	Detailed design approved, LLI's expedited	
2026			
Q1	Gen 1	Procurement, Construction	
Q2	Gen 1	Commissioning	
Q3	Gen 1	Operation, test runs, adjustments	
Q4	Gen 2	Design adaptations for next scaleup	

Technology Roadmap



Thank You!

